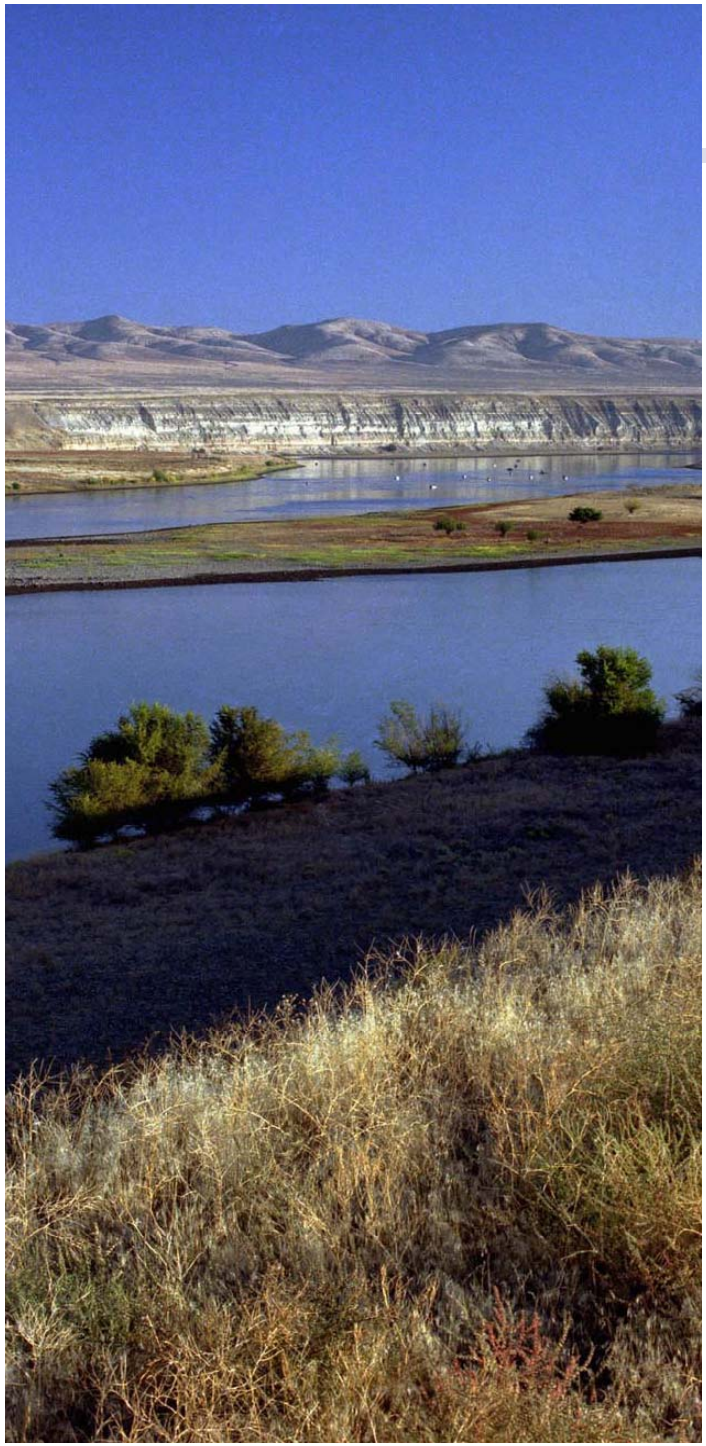


Mobile Arm Retrieval System (MARS)

Brian J. Stickney
Tank Farm Operations Division
Office of River Protection

Presented to the
2011 Facility Representative Workshop
May 5, 2011

U.S. Department of Energy

Office of River Protection

Agenda

- What is MARS?
- Background
- Sound Tank MARS System Overview
- C-107 Dome Cut
- Q & A

Office of River Protection

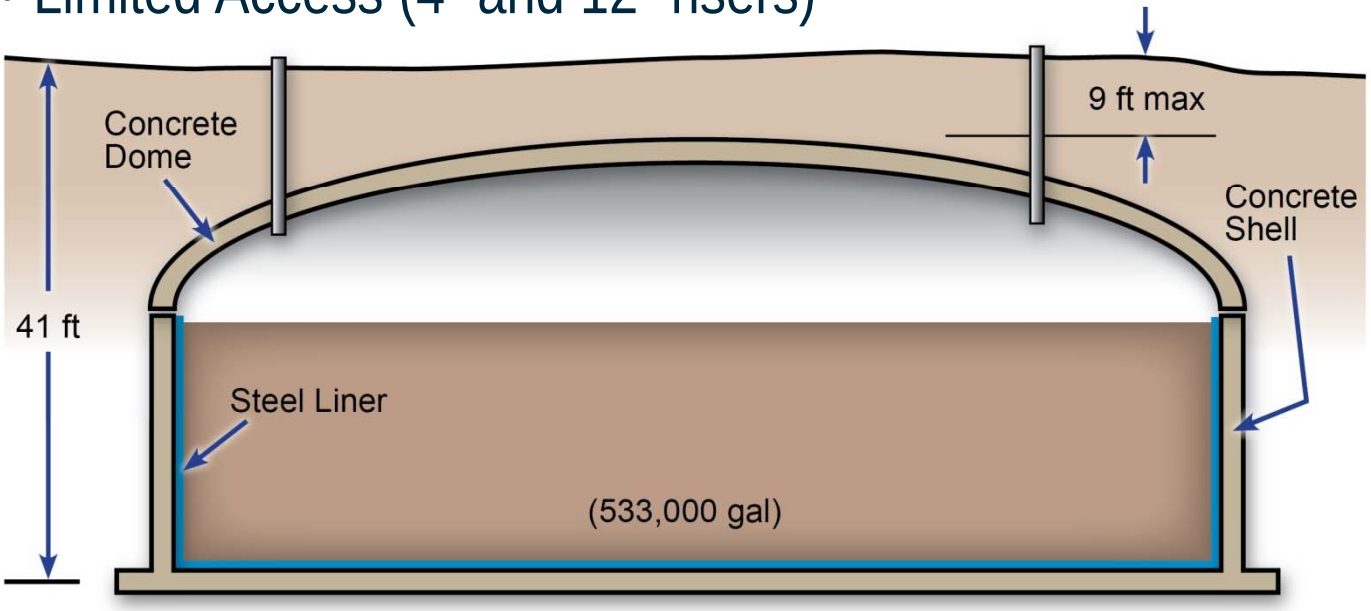
What is MARS?

- The MARS is a telerobotic arm based retrieval system
- Two Versions:
  - Bulk retrieval version (sound SSTs with waste up to 10 feet in depth)
  - Eductor retrieval version which will be used on leaking SSTs with waste depth up to 5 feet 10 inches
- Deployment of either version of the MARS will be through a new large diameter riser installed in the center of the SST dome

Office of River Protection

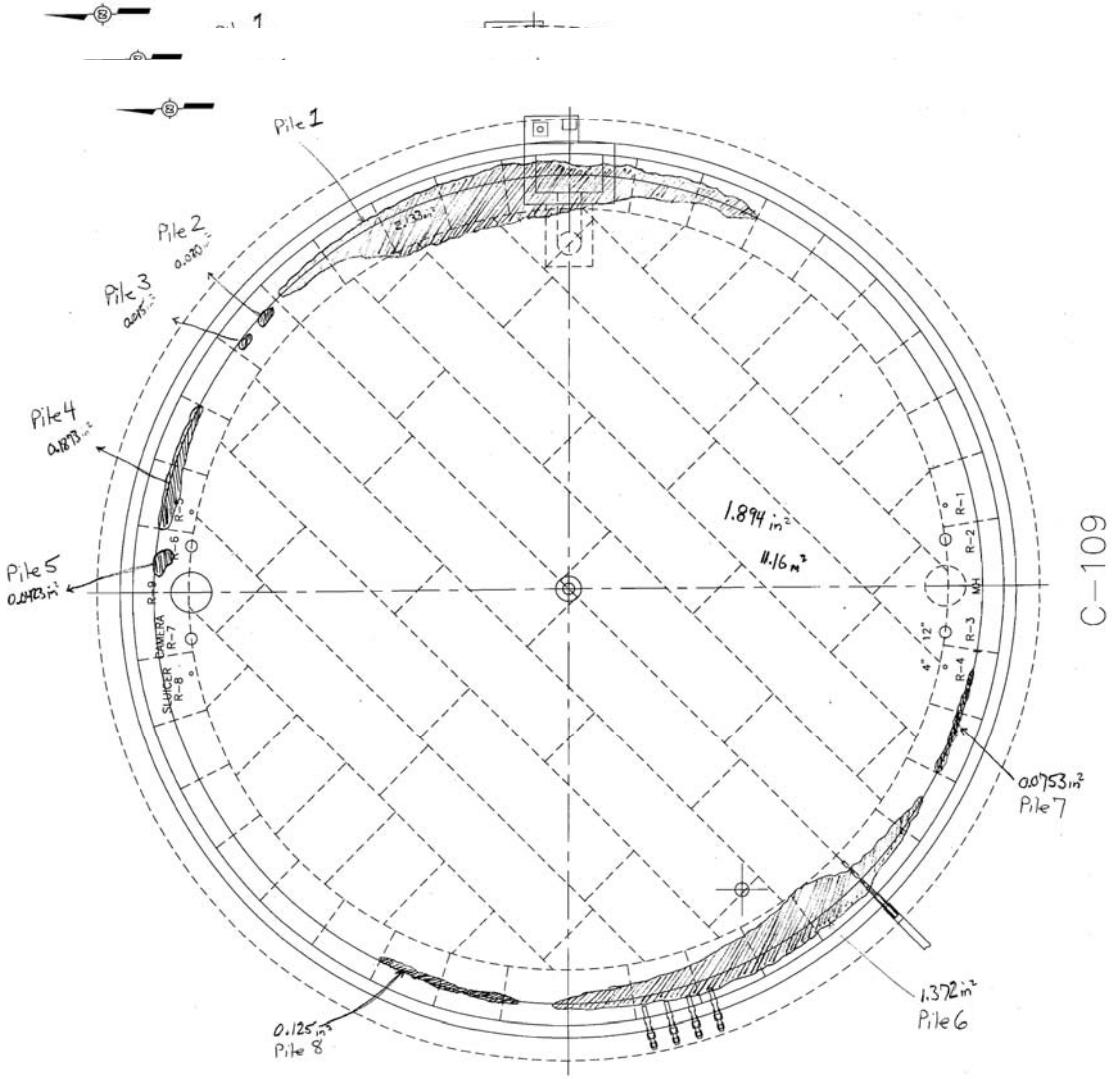
Single-Shell Tank Retrieval Difficulties

- Typical Single-Shell Tank
  - Carbon Steel Liner
  - 75’ diameter
  - ~41’ height
  - Concrete Dome (15” Thick)
  - Limited Access (4” and 12” risers)



First Single-Shell 100-Series Tanks
241-B, C, T, U Tank Farms

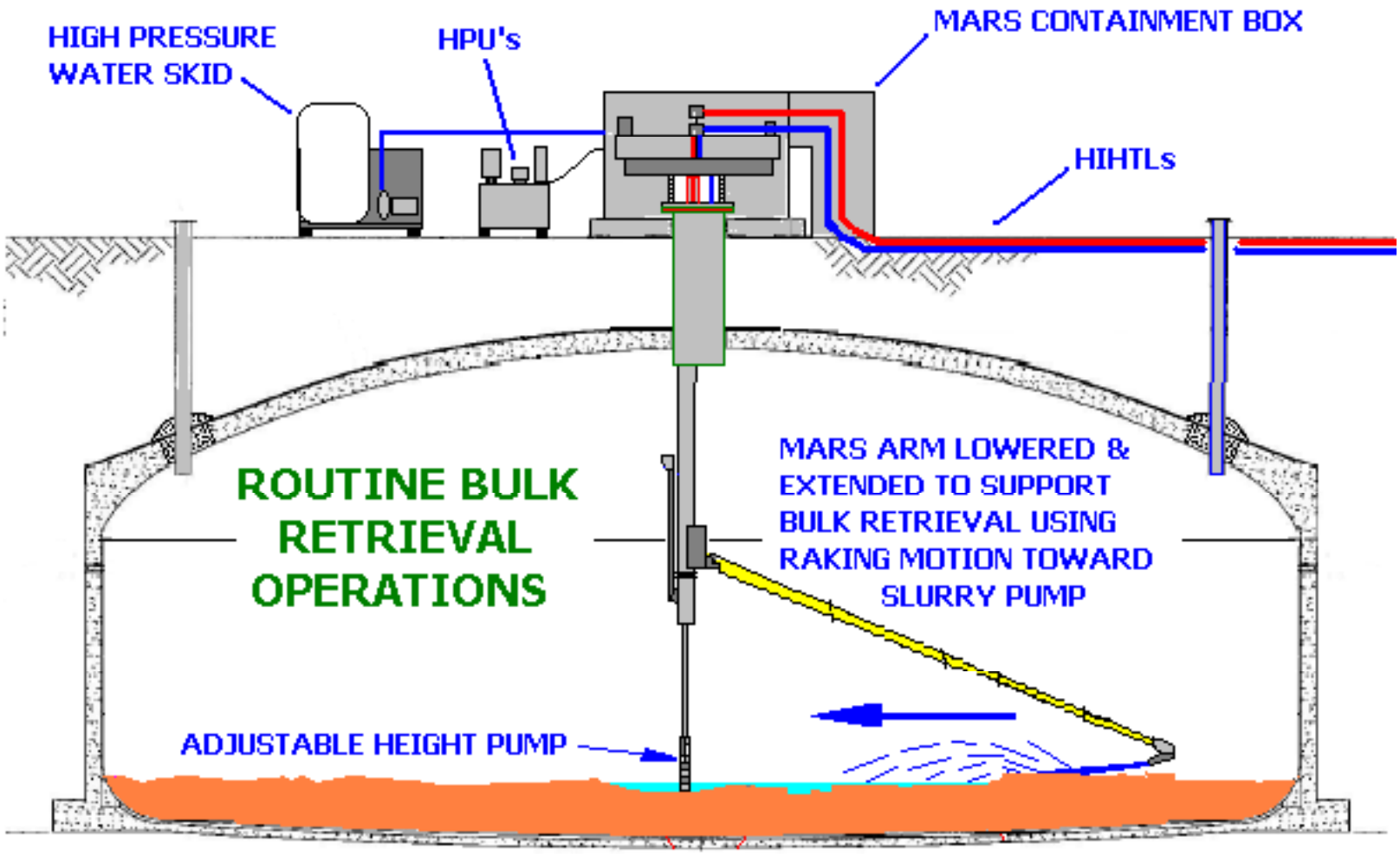
Background- Sludge Mounds in C-109



1.894 in² = 11.16 m²

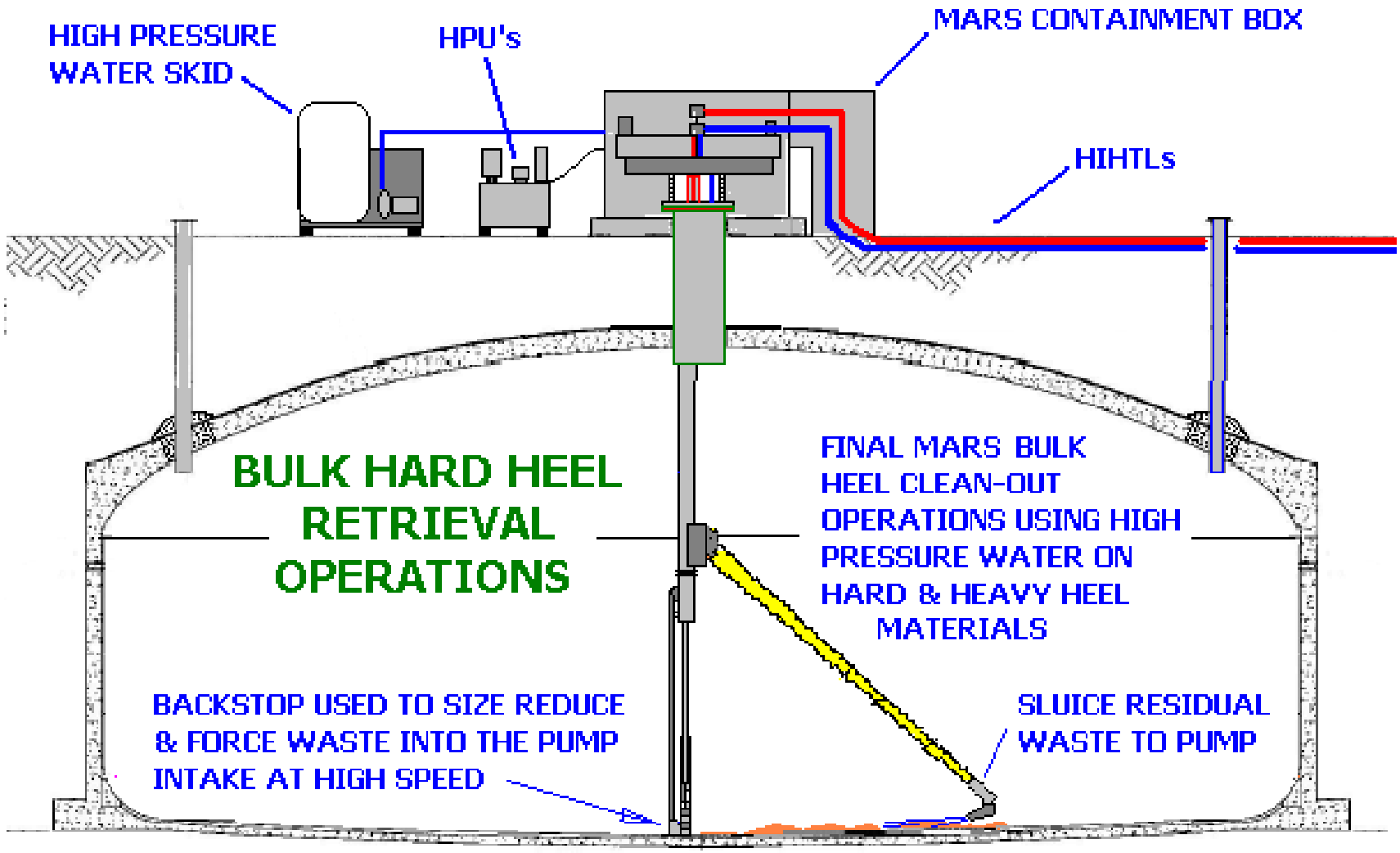
1 in² = 5.892 m²

MARS - Sound Tank System *(Bulk Retrieval)*



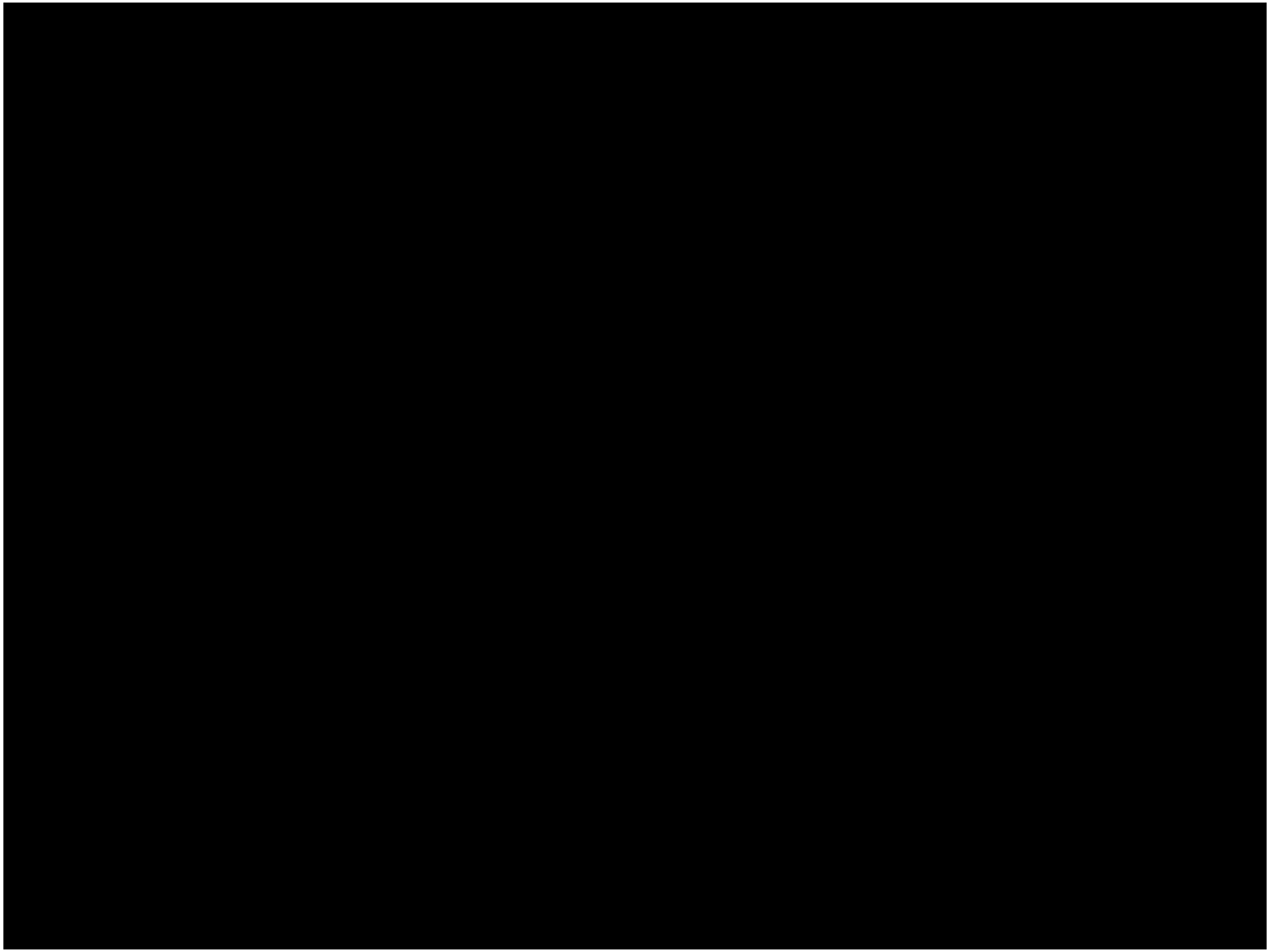
C FARM SINGLE-SHELL TANK

MARS - Sound Tank System *(Hard Heel Retrieval)*



C FARM SINGLE-SHELL TANK

MARS Video



Sound-Tank MARS- Recent Activities

- Parallel effort to MARS development activity, to begin field design for installation of MARS in C-107. Largest activities in this effort are:
  - Equipment removal
  - Ventilation upgrades
  - Large Riser installation

Office of River Protection

Large Riser Installation

- Largest Riser on C-107 – 12”
- December 19, 2010 – 55” cut made in C-107 tank dome
  - Cut through ~15” of concrete and steel rebar using high pressure water and fine grit garnet
  - Approximately three gallons per minute at a pressure of 48,000 psi, cutting 8 inches per hour (<24 hours to complete)
  - ~2,500 lbs of garnet used
  - Largest ever cut into an active DOE radioactive waste storage tank
- New 42” riser installed

Office of River Protection

C-107 Excavation

Office of River Protection

C-107 Saltwell Pad Removal

Office of River Protection

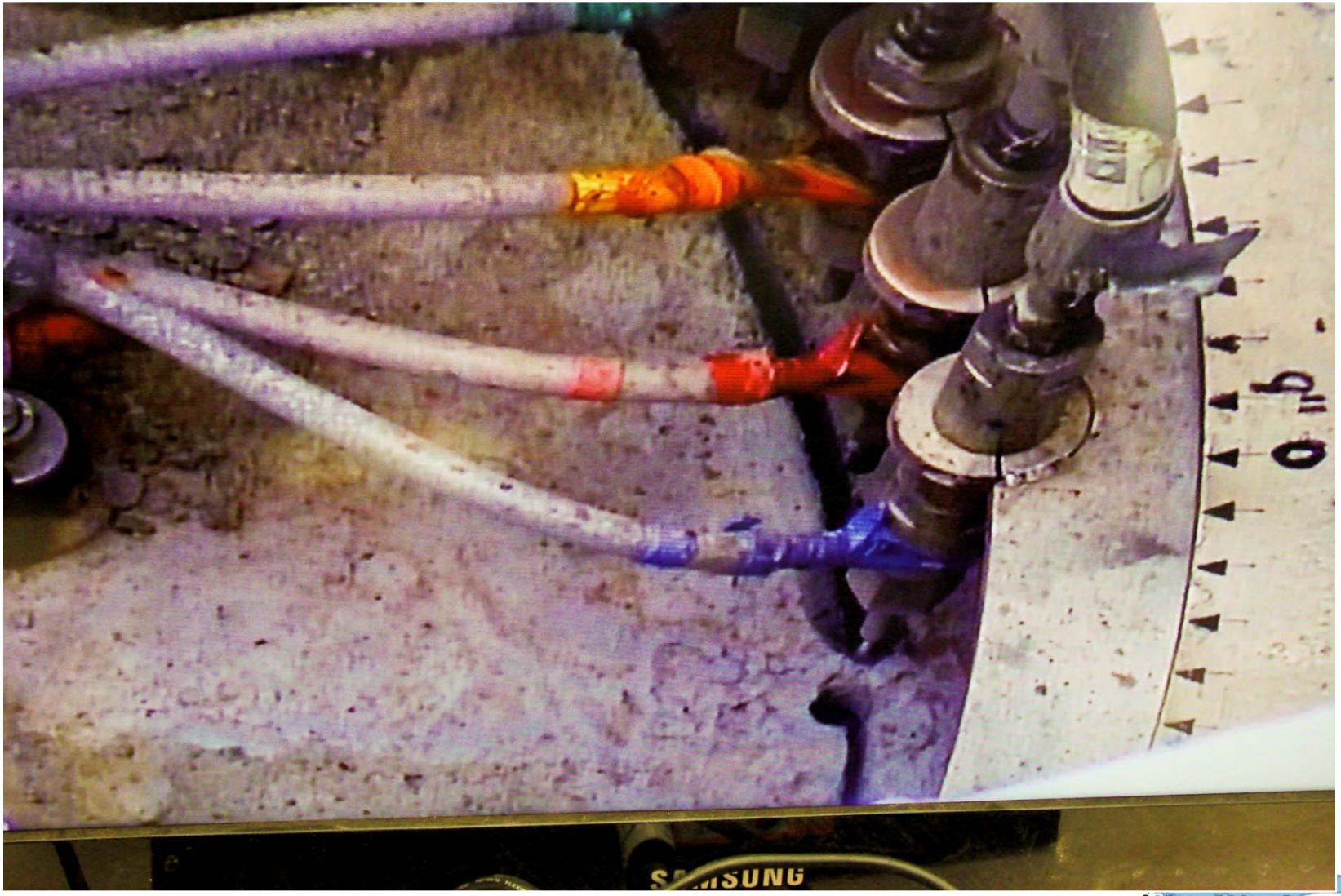
C-107 Dome Cut Template

Office of River Protection

C-107 Dome Cut Setup

Office of River Protection

Completion of Garnet-Entrained Cutting



Office of River Protection

Removal of C-107 Dome Plug

Office of River Protection

Installation of new C-107 MARS Riser

Office of River Protection

New Riser at C-104

Office of River Protection

C-107 Dome Cut Lessons Learned

- Garnet-entrained water cutting method provided superior cutting ability while preventing the spread of contamination
  - No contamination was found in the vicinity of the cut despite a full penetration of the dome into the dome headspace
- Top hat (a flanged device on the top of a riser that enters into the dome space) usage provided a structure on which to attach the dome core radiological protection sleeving and provided fall protection
- Garnet-entrained water cutting equipment was operated remotely ensuring ALARA
- Garnet-entrained water cutting method was robust enough to continue operations in below freezing weather with heaters to prevent freezing in the compressor system air lines

Office of River Protection

Background

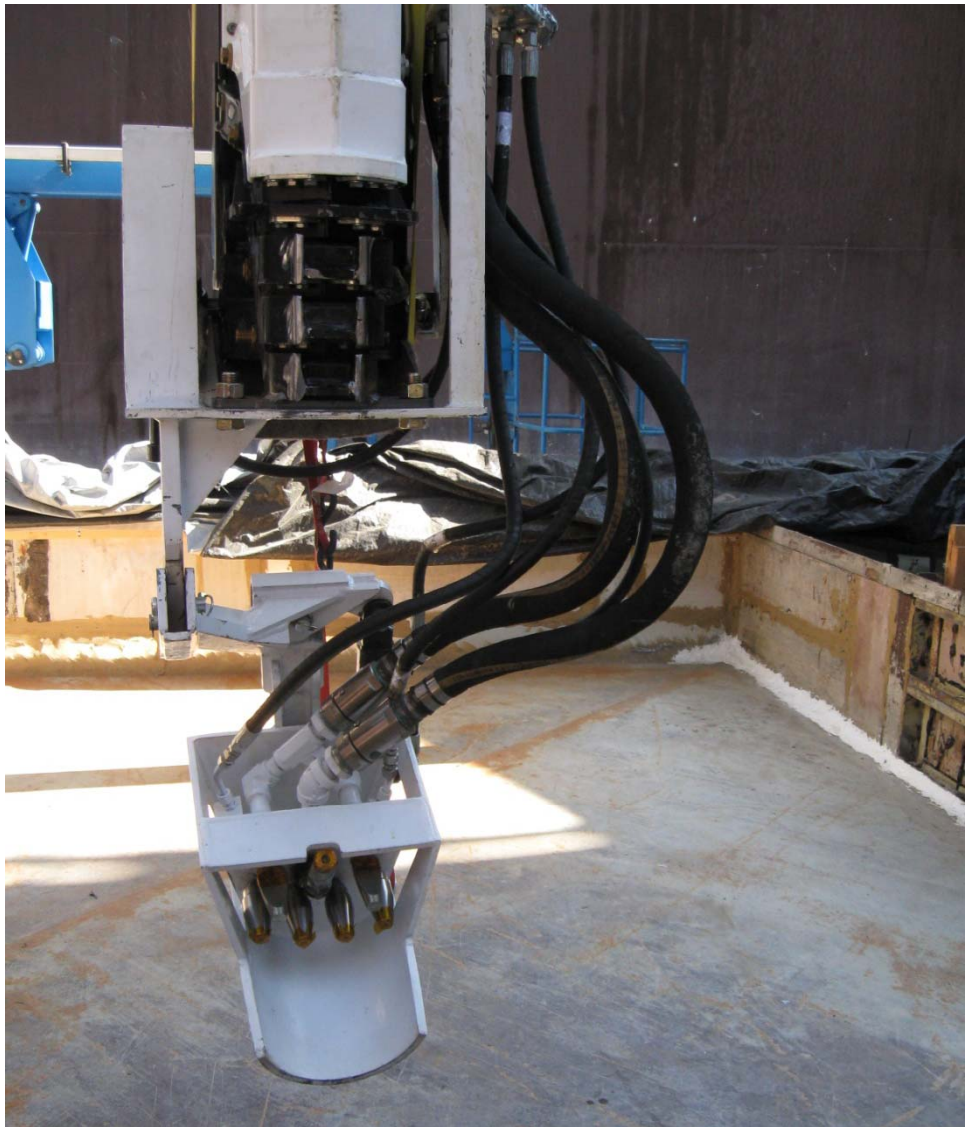
- DST Space is Limited Until WTP is On Line
  - C-Farm, A-Farm, AX-Farm
- Use of Sluicing for Bulk Retrieval has been Effective, however:
  - Hard Heel and Residuals remain ~ 10% of starting volume
- Required to remove key radionuclides to the maximum extent technically and economically practical (DOE M 435.1-1)
- Method of Retrieving Waste from Assumed Leakers

Office of River Protection

Sound-Tank MARS- Wrist/End Effector

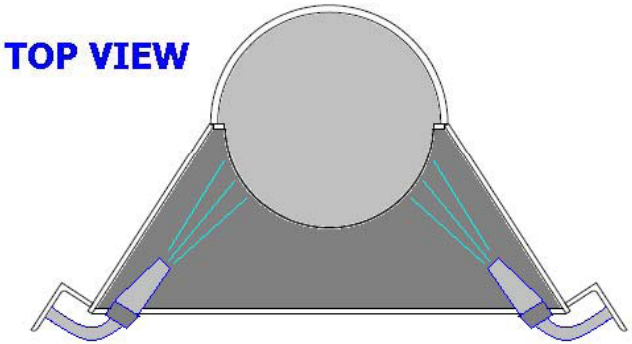
Office of River Protection

Sound-Tank MARS- Wrist/End Effector



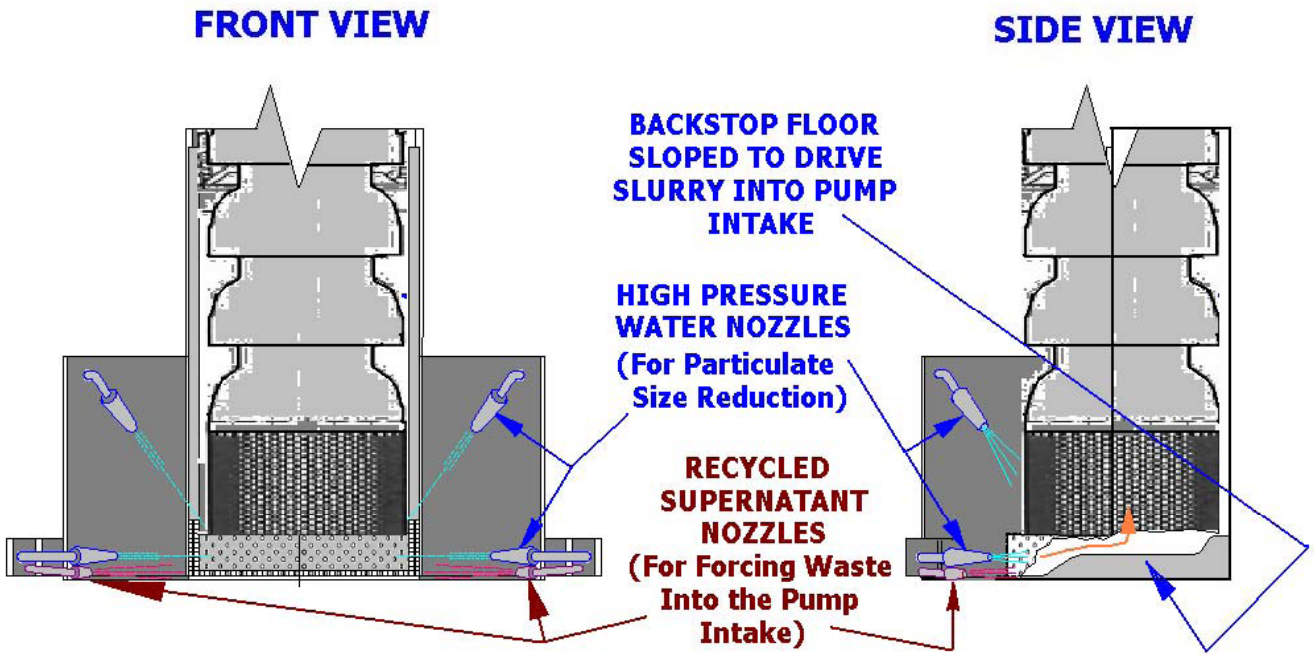
Office of River Protection

Backstop Assembly



THIS IS THE MARS BACKSTOP ASSEMBLY WHICH IS MOUNTED ON THE BOTTOM OF AN ARTICULATION ASSEMBLY SHOWN IN FIGURE 3-1.

IT INCLUDES HIGH PRESSURE WATER AND RECYCLED SUPERNATANT NOZZLES TO SIZE REDUCE THE WASTE HEELS AND FORCE THEM INTO THE PUMP INTAKE AT SPEEDS ADEQUATE TO MAINTAIN SUSPENSION OF THE SOLID PARTICULATE



Flow Rates and Pressures

PROCESS STREAM	FLOW RATE(GPM)	PRESSURE RANGE (PSI)
End-effector high-pressure water waste mobilization/size reduction nozzles (4 nozzles at up to 5.0 gpm each)	0 to 19	1,000 to 4,950
High-pressure water to backstop size reduction nozzles (4 nozzles at up to 4.5 gpm each)	0 to 19	1,000 to 4,950
End-effector recycled supernatant at a distance waste mobilization nozzle (1 nozzle at up to 90 gpm)	0 to 90	100
End-effector recycled supernatant close proximity mobilization nozzles (2 fan nozzles at up to 32 gpm each)	0 to 64	100
Backstop assembly recycled supernatant waste mobilization nozzles (2 nozzles at up to 32 gpm each)	0 to 64	100

Office of River Protection